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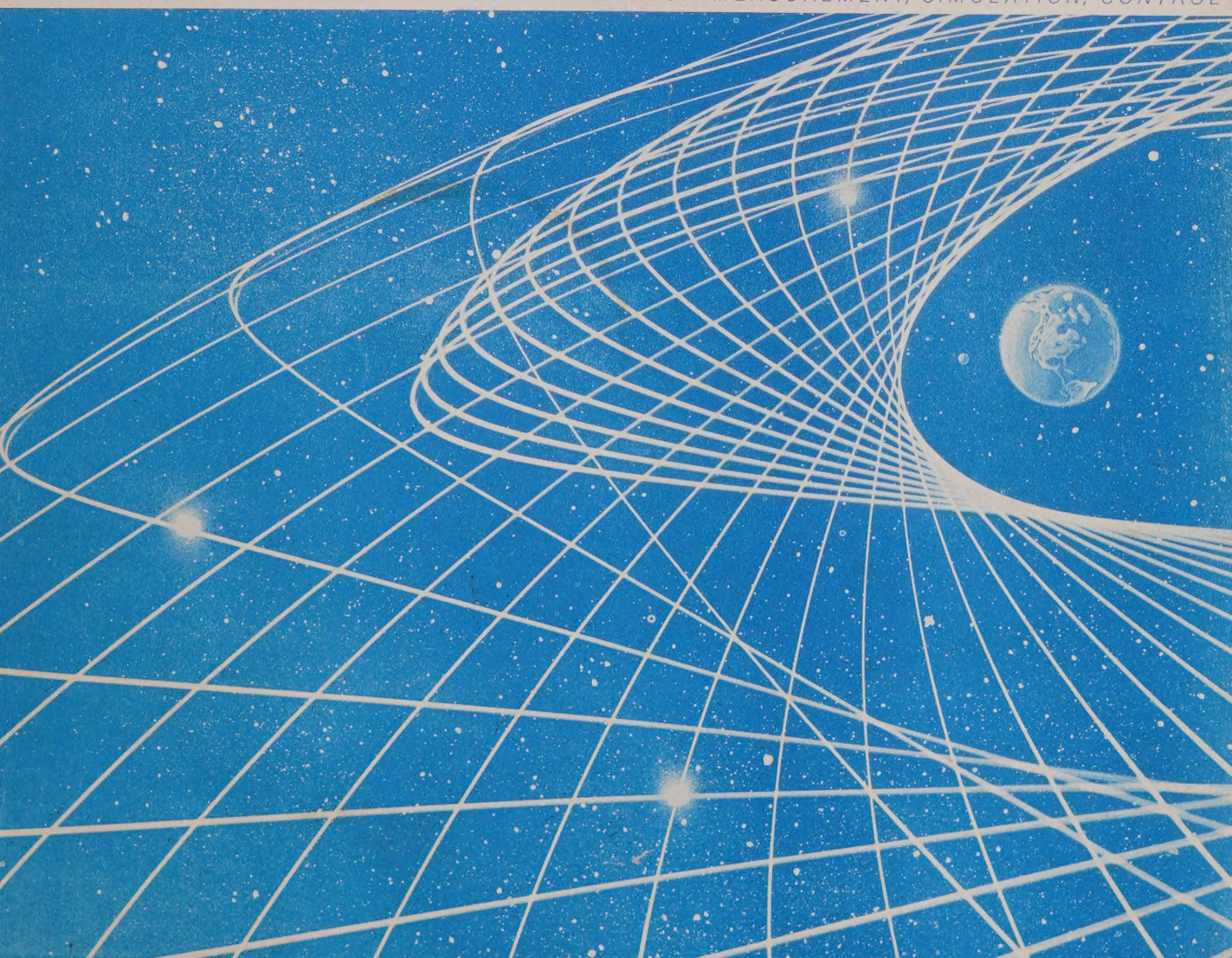
SYSTRON DONNER
CORPORATION

Instruction Manual

ELECTRONIC AND INERTIAL INSTRUMENTATION FOR MEASUREMENT, SIMULATION, CONTROL



MODEL 1944 PRESET PLUG-IN

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SYSTRON DONNER

CORPORATION

WARRANTY

Systron-Donner instruments are warranted during a period of one year from date of shipment to original purchaser to be free from defects in material and workmanship. This warranty does not apply to vacuum tubes, except as they are warranted by tube manufacturers. The liability of Seller under this warranty is limited to replacing or repairing any instrument or component thereof which is returned by Buyer at his expense during such period and which has not been subjected to misuse, neglect, improper installations, repair, alteration, or accident. Seller shall have the right of final determination as to the existence and cause of a defect. In no event shall Seller be liable for collateral or consequential damages. This warranty is in lieu of any other warranty, express, implied or statutory, and no agreement extending or modifying it will be binding upon Seller unless in writing and signed by a duly authorized officer.

RECEIVING INSPECTION

Every Systron Donner instrument is carefully inspected and is in perfect working order at the time of shipment. Each instrument should be checked as soon as received. If the unit is damaged in any way or fails to operate, a claim should immediately be filed with the transportation company.

REPAIRS

Whenever a Systron-Donner instrument requires service, the nearest Systron-Donner representative should be contacted; all representatives will provide immediate service or arrange factory returns when necessary.

Please specify both model and serial number in all correspondence concerning Systron-Donner instruments. Address all inquiries on operation or applications to your nearest sales representative or Sales Manager, Instruments, Systron-Donner Corporation, 888 Galindo Street, Concord, California.

SECTION I

GENERAL DESCRIPTION

1-1 INTRODUCTION

1-2 The Model 1944 Preset Plug-in is designed for use with any of Systron-Donner's digital measuring instruments with the versatile front plug-in design. The plug-in is provided with six distinct operating functions and can be used as a frequency meter, straight high speed counter, preset counter, period or pulse-width timer, flowmeter calibrator, or ratio measuring instrument. When installed the preset plug-in enables the counter to readout measurements directly in engineering units. By proper adjustment of the front panel counter controls, the input signal can be read out directly in GPM, lb/sec, feet, yards, or any other convenient engineering unit.

1-3 Each plug-in unit contains one input channel which features AC or DC coupling, a five step 1:100 attenuator, variable trigger level control for precise selection of timing intervals and optimum count reliability, and slope selection for triggering with either positive or negative going wave forms.

TABLE 1-1 Model 1944 Preset Plug-in Specifications

PRESET FUNCTIONS	N = 1 to 99,999
[illegible]	[illegible]	DC to [illegible]
Period/N	Measures period in N X 10 μsec Timing Units	DC to [illegible]
Period X N	Times Period of N input cycles	[illegible]
Rate/N	Divides input frequency by N	DC to 100 Kc
[illegible]	[illegible]	DC to [illegible]
NORMAL FUNCTIONS	DC to 10 Mc
Rate, - Period, - Count - Test	
INPUT	
[illegible]:	0.1 v rms
[illegible]	[illegible] on 1, 3 attenuator positions
	[illegible] on 10, 30, 100 attenuator positions
Coupling:	AC or DC, switch selectable
Slope Selection:	± for both Start and Stop
TIME BASE SELECTION	
Normal Rate/N Count/N	10^{-6}, 10^{-5}, 10^{-4}, 10^{-3}, 10^{-2}, 10^{-1}, 1, 10
Rate X N Period/N	10 μs to .99999 secs in 10 μs steps
	100 μs to 9.9999 secs in 100 μs steps
	1 ms to 99.999 secs in 1 ms steps
	10 ms to 999.99 secs in 10 ms steps
	100 μs to 9999.99 secs in 100 ms steps
	1 sec to 99999. secs in 1 sec steps
OUTPUT	
Positive 6 volt pulse, period equals [illegible] x Time Base setting (N x Rate and Period/N) start[illegible] on first input sign[illegible]	

SECTION II

INSTALLATION

2.1 INITIAL INSPECTION

2.2 As soon as the Model 1944 is received, verify that the instrument is intact and as ordered. Inspect the plug-in for any physical damage such as scratched panel, broken knob, or bent connectors. If damage is found, refer to the warranty page at the rear of this manual and Paragraph 2-5 for shipping and re-packaging instructions.

2.3 STORAGE AND RESHIPMENT

2.4 ENVIRONMENT -- Conditions during storage and shipment should be limited as follows:

a. Maximum temperature +85°C
b. Minimum temperature -55°C

2.5 PACKAGING -- To protect your instrument during shipment or storage, use the best packaging methods available. Your Systron-Donner field office can provide materials similar to those used for original factory packaging. Contract packaging companies can provide dependable custom packaging on short notice.

a. If possible, use the original container designed for the instrument. Otherwise, use a strong carton (350 lb/sq inch bursting strength) or wooden box to house the instrument.

b. Wrap the instrument in heavy paper or plastic before placing it in the shipping container.

c. Use plenty of packing material around all sides of the instrument and protect the front panel with cardboard strips.

d. Seal the package with strong tape or metal bands. Mark with "Delicate Instrument".

e. Refer to the warranty page at the rear of this manual and check with your Systron-Donner field office for shipping instructions. All correspondence should refer to an instrument by model number and serial number.

2.6 INSTALLATION

2.7 To install the preset plug-in in the compartment provided at the right side of the counter front panel, proceed as follows:

a. Remove AC power from the counter.

b. Loosen locking screw on side of the plug-in compartment by turning fully counter clockwise.

2.7 c. Remove blank filler panel or plug-in unit installed.

d. Make certain the 50 pin jack at the rear of the plug-in is properly aligned with the mating connector in the counter and slide the plug-in into the counter.

e. Tighten locking screw by turning fully clockwise.

2.8 COOLING

2.9 The plug-in unit is cooled by the ventilation of the counter in which it is installed.

2.10 POWER REQUIREMENTS

2.11 All voltages required to operate the Model 1944 are supplied by the circuits of the counter in which the plug-in is installed.

2.12 ELECTRICAL CONNECTIONS

2.13 The INPUT terminal on the front panel of the plug-in provides the only connection for the input signal. The front-panel OUTPUT connector supplies the output for monitoring or external equipment. All connections to the counter are completed through the 50-pin jack at the rear of the plug-in unit.

SECTION III

OPERATION

3.1 TRIGGER LEVEL CONTROL

3.2 The "Level" control on the plug-in enables one to select the DC voltage level which will produce consistent triggering of the counting circuitry. The trigger voltage level is adjustable between approximately +3 volts and -3 volts with reference to the attenuated input signal. In terms of the unattenuated signal applied to the input jack, the trigger level is equal to the product of the selected attenuation factor and the trigger level voltage of the attenuated signal.

3.3 Adjust counter trigger level as follows:

(1) Set function switch to COUNT.
(2) Turn LEVEL control until counter starts to count.
(3) Continue turning LEVEL control until counter ceases to count.
(4) "Back-off" LEVEL control to mid-point between the "start count" and "stop count" limits.

3.4 This is a convenient way to select a trigger voltage level at approximately the center of the steepest slope of the input waveform and will reduce the possibility of spurious pulses from noise causing false count. The relationship between triggering level and attenuation is illustrated in Figure 5-2.

3.5 SLOPE CONTROLS

3.6 The Model 1944 Plug-in is provided with slope switches which are used in conjunction with the Trigger voltage controls. In the "+" position, the channel will produce a triggering pulse when the input signal rises to the selected trigger voltage level, and in the "-" position when the signal falls to the selected trigger voltage level. In the Period measurement, both slope switches must be set to the same polarity in order to measure one complete cycle of the signal applied to this channel. In multiple Period measurements it is not possible to measure a half cycle.

3.7 It should be noted that the trigger levels for + slope and - slope settings do not exactly coincide because of "hysteresis" in the trigger circuit. This results in an upper trigger level for a positive-going input and a lower trigger level for a negative-going input, as illustrated in Figure 3-3. Both trigger levels must be intersected to produce a complete triggering cycle. These levels are separated by less than 0.3 volt peak-peak, which determines the minimum input voltage or sensitivity of the amplifier channel. In making time interval measurements, using both the + and - triggering slopes, hysteresis must be taken into account for accurate results.

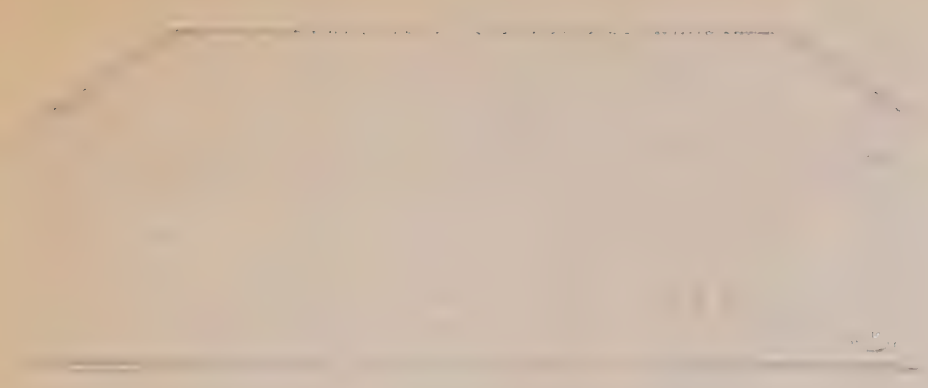


FIGURE 3-1 Model 1944 Preset Plug-in Installed in Model 1037 Counter

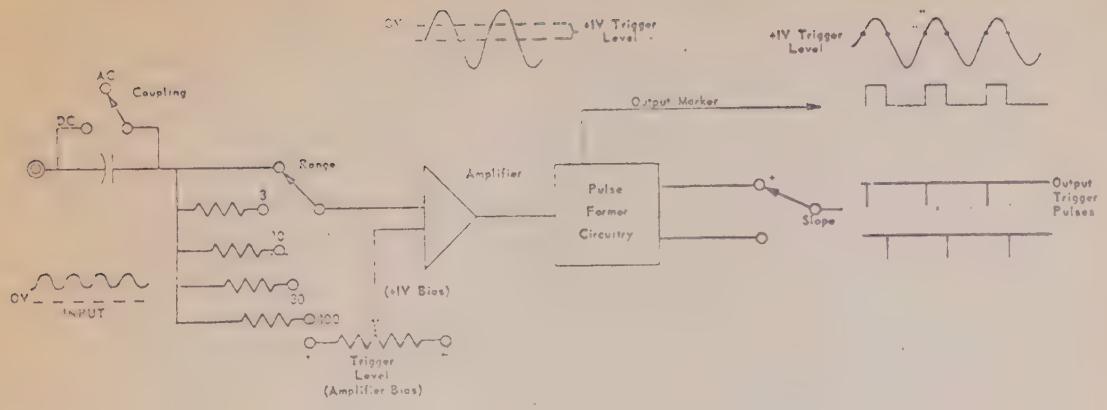
TABLE 3-1 Function vs Control Setting

FUNCTION SELECTED/READOUT	CONTROL SETTINGS
1. Period/N Readout will be period of input signal divided by thumbwheel switch setting.	(a) Set counter function switch to [illegible] or PER X10 (b) Set in desired number (N) with plug-in thumbwheel switches.
2. Rate/N Readout will be input rate divided by thumbwheel switch setting.	(a) Set counter function switch to RATE or RATE X10 (b) Set in desired number (N) with plug-in thumbwheel switches.
3. Period X N Counter readout will be the period in μs, ms or sec times thumbwheel setting.	(a) Set counter function switch to PER or PER X10 (b) Set desired number (N) with thumbwheel switches.
4. Rate X N Readout will be input rate times thumbwheel switch setting.	(a) Set counter function switch to RATE or RATE X10 (b) Set in desired number (N) with plug-in thumbwheel switches.
5. Count/N Counter readout will be continuous counting of prescaled plug-in input - totalizing in groups of N (batching).	(a) Set function switch to COUNT (b) Set in desired number (N) with plug-in thumbwheel switches.

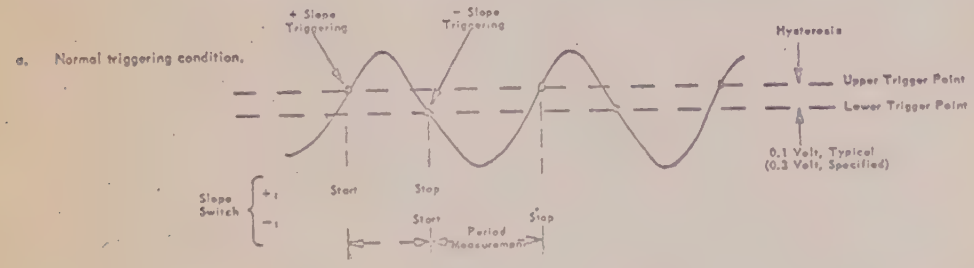
Continued on following page.

TABLE 3-1 Function vs Control Setting --- (con't.)

FUNCTION SELECTED/READOUT	CONTROL SETTINGS
A. Normal 1 - Frequency Readout will be number of events which occur within the unit of time selected with TIME BASE switch. Is frequency of cyclic of input signal. (should be used for measuring higher frequencies)	(a) Set function switch to RATE or RATE X10 (b) Set TIME BASE switch to any convenient setting. (c) See counter manual (Section III)
2 - Period Readout will be number of time base pulses which occur during selected period. (should be used for measuring lower frequencies)	(a) Set function switch to PER or PER X 10 (b) Set both SLOPE switches to (+) or (-) (c) See counter manual (Section III)



Input Control Functions
FIGURE 3-2



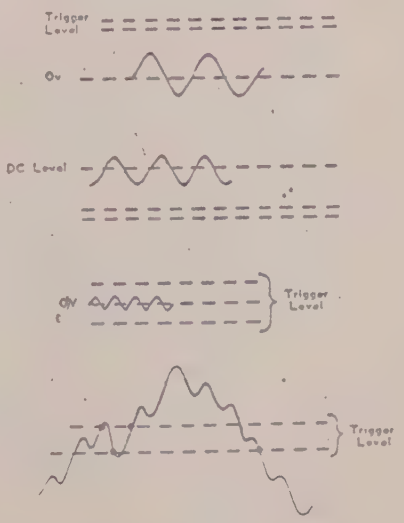
a. Normal triggering condition.

b. No triggering with AC coupling (Trigger level is too high or too much attenuation)

c. No triggering with with DC Coupling OK with AC Coupling (Trigger level is too low relative to attenuation.)

d. No triggering on AC Coupling and 0 volt trigger level. (Too much attenuation.)

e. Spurious triggering from excessively large noise component.



Relationship Between Trigger Voltage Level & Attenuation
FIGURE 3-3

(REV. 1-65)

[illegible]

[illegible] on the Rate (c) [illegible] selects an attenuation factor of X1, [illegible], or 100. Both the AC and DC components of the input signal are [illegible] the selected attenuation factor. [illegible] attenuated to within ±10 volts peak-to-peak to protect the attenuator [illegible] overload. If the signal is attenuated to approximately 0.25V peak-to-[illegible], the instrument will not count. To minimize the effects of noise, it [illegible] desirable to select an attenuation factor that will reduce the noise component of input signal to less than 0.25 volts peak-to-peak. Even when properly attenuated, the maximum signal which should be applied to the input connector is 50 volts peak-to-peak. Larger signals must be attenuated externally.

[illegible]

The digital thumbwheel switches on the Preset Plug-in can be set to any number from 1 to 99,999. They may be used to select a precise time base for frequency measurements or a special clock frequency for timing functions.

PLUG-IN FUNCTION SELECTOR

Three positions select PERIOD X N Period, Rate/N, Count/N; and Period/N, Rate X N.

Rate X N (Counting Frequency)

With the plug-in function selector at "Rate X N" the instrument will measure frequency by counting the number of cycles which occur during a precise, variable time interval. When the frequency to be measured is the output signal of a tachometer, flow transducer, or other transducer, the counting interval may be selected to provide [illegible] meaningful units such as gals/min, lbs/hour or [illegible]. For example, if a flowmeter generates 1750 cps at a flow rate of 1750 gal/min, you would select a counting interval of 1.000 divided by [illegible]. This would cause [illegible] to indicate "1000" at 1750 gal/min. This counting interval at rate over the full range will be indicated in tens of pounds per hour. When used with other transducers, a different adjustment of the counting interval will produce readings in cfm, psi, or any other desired units. Once set up, the instrument will make [illegible] measurements automatically.

PER X N (Measuring Period)

[illegible]ed to "Period X N" the instrument will [illegible] any number of input [illegible] from one to 9[illegible]. The [illegible] input to period measurements can be [illegible]y measuring the [illegible] a large number of cycles.

[illegible] of input signal are [illegible] by positioning the digital switches [illegible] desired number of cycles to be measured and rotating the "All" [illegible]itch to the digital [illegible]. For example, by setting the digits of a large [illegible] cycles, the [illegible] of [illegible] elements will be entirely [illegible]

3.16 RATE/N

In the RATE/N position, the 1944 divides the input rate by the preset number. The counter accumulates the pre-scaled input for a period of time determined by the Time Base setting.

3.17 PERIOD N

The counter is started and stopped by the input signal. The Time Base signal is divided by N and accumulated in the counter.

3.18 COUNT N

The counter continuously counts the input rate pre-scaled by N.

3.19 NORMAL

The Plug-in provides only input amplification, attenuation, slope control and trigger level control. All other functions are set with the counter controls.

SECTION IV

CIRCUIT DESCRIPTION

4.1 INPUT ATTENUATOR -- The input attenuator includes five divider networks of either 10 megohms, or 1 megohm impedance, by-passed by 50 pf. Adjustable trimmer capacitors are provided for frequency compensation. These are factory-adjusted to obtain proper compensation with a squarewave input. The input circuit of the amplifier has limiters which permit signals up to 500 volts peak-to-peak to be applied to the input terminals. The Trigger Level potentiometer adds a DC bias opposite in polarity to the sign indicated on the panel, to the amplifier input. When the DC level of the input signal is equal to the indicated trigger voltage, a triggering pulse is produced at the amplifier output.

4.2 D. C. AMPLIFIER SECTION (Refer to Dwg. 11111) -- A "Nuvistor" tube is used in the input stage because of its high frequency response and input impedance characteristics. Limiting diodes CR101 and CR102 protect the tube from overload by limiting the grid to ±6 volts. The input stage, V101, functions as a cathode follower having very high input impedance and low output impedance for operation into the following transistor circuits. Q101 is an emitter-follower driving the amplifier stage Q102. Potentiometer R108 is the trigger zero adjust potentiometer. It is adjusted so that an output trigger pulse is produced when the input signal passes through zero volts and the TRIGGER LEVEL control is set at "0".

4.3 The amplified output of Q102 which may be a clipped waveform when a sinewave input is applied, drives the following Schmitt Trigger circuit, Q106 and Q107 thru emitter followers Q103 and Q104 and the limiting network between them. This circuit has two stable conditions and is triggered from one state to the other when the signal voltage applied to it passes through a threshold level of approximately 0.05 volts in the positive direction or 0.25 volts in the negative direction, as measured at the collector of Q102.

4.4 The 0.40 volt difference between [illegible], referred to as the hysteresis of the Schmitt trigger, is the minimum signal amplitude required to operate the trigger and is equivalent to much less than the rated input sensitivity for channels A. (0.1 volt r.m.s. at the input terminals.) The output of the Schmitt Trigger is a squarewave, regardless of the input waveform applied.

4.5 The Schmidt Trigger drives two pulse transformers, T101 and T102. Q105 in the emitter circuit of the Schmidt Trigger provides a constant current source which compensates for the loading effect of the output transformers to help preserve the output squarewave. Each output pulse transformer produces a negative differential waveform, corresponding to either a positive-slope or a negative-slope on the primary, depending on which side of the center-tapped secondary winding is grounded by the SLOPE switch. These negative pulses are fed to the bases of Q108 (A^1 output) and Q109 (A^1 output) which amplify, invert and lengthen them.
Two output pulses from the "A" channel permits the start and stop channels to be operated by inputs of different slopes.

SECTION V

MAINTENANCE AND PARTS DATA

[illegible] AMPLIFIER (Sensitivity Adjustment)

a. Attach the scope probe to test point which is located at the top of R103.

b. Set range switch to position 1; AC/DC switch to AC position.

c. Apply a 300 mv, peak-peak 1 Mc square wave from test oscillator [illegible].

d. Adjust C7 for a rectangular square wave.

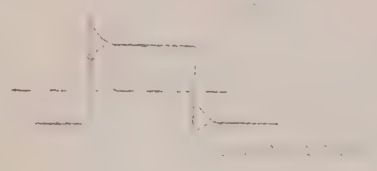


Figure 5-1

e. Set range switch to position 3, increase amplitude of test oscillator to 3 volts peak-peak. Adjust C7 in a similar way.

Figure 5-2 Amplifier Parts Location Detail

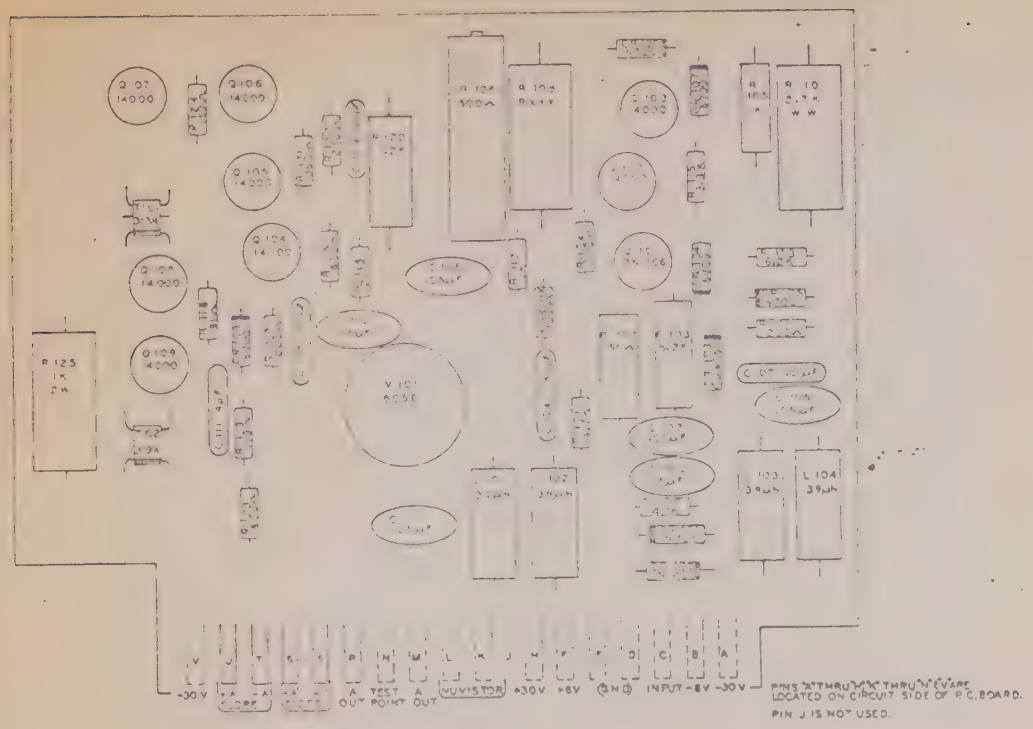
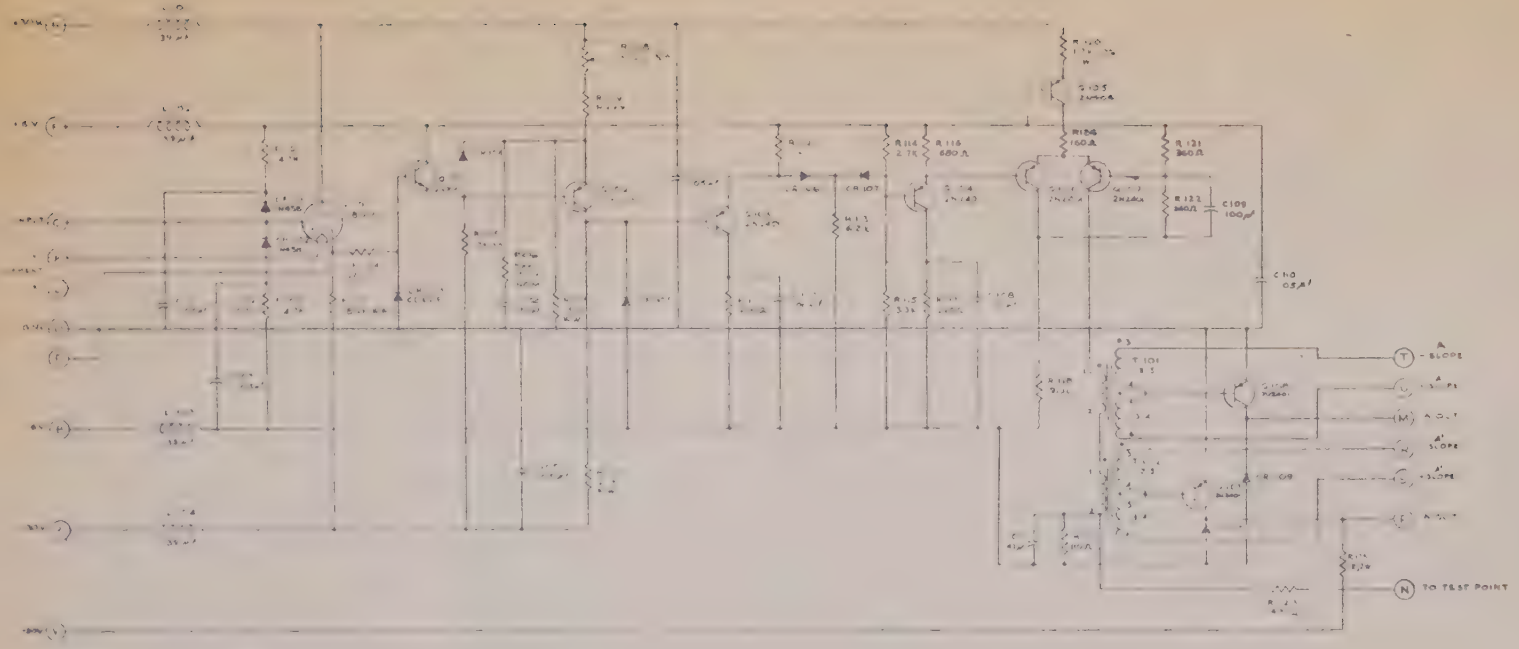
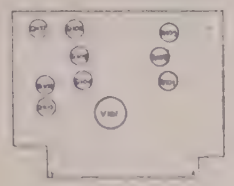


Table 5-1 Plug-In Amplifier Assembly Parts List

Part No.	Description	Reference
J-0261	Connector	Amphenol Blue Ribbon 57-10500
S-0110	Switch, DDPT	S2, S4, S5, S6, S7
J-0133	Banana-Jack-White	
11637	Knob-Black & Red	R.B 999-700
J-0260	Connector	BNC
E-0137	Ground Lug	BNC Type
J-0265	Connector	Viking VH 18/1AB5
H-0980	Screw - Phillips	4-40x1/4
H-0981	Screw-Hex HD-Self Tap.	4-40x1/4
H-1065	Screw - Phillips	4-40x1/2
H-0734	Washer, Cad Pl. Steel	#4
H-0441	Hex Nut	4-40
H-0951	Terminal Strip	Cinch 1540
H-0845	Ground Lug	
H-0453	#4 Tinnerman	
H-0954	Drive Rivet - 1/8 x 3/16	Southco #38-504-03
H-0404	Rivet - 1/8 x 1/8	
H-0758	Washer - #4 Flat	
C-0382	Capacitor .1 uf	C13, C26
R-0966	Resistor, 100Ω, 1/4w 5%	R14, R28
R-0259	Resistor, 2.2K 1/2w	R29, R30
R-1577	Resistor, 3.9K, WW	R6, R8, R20, R22
C-0708	Capacitor .05 uF	C5, C6, C18, C19, C27, C28
CR-0095	Diode, 1N751A	CR1, CR2
R-1045	Resistor, 2.4K, 5%	R31, R32
R-0466	Resistor, 100Ω, 1/2w 5%	R33, R34, R35
H-0745	4-40x3/8 FHM	Pull - Front Panel
	Coax	
	Insulated Shield	
	Wire #22 GA - Stranded	
	Bussing	
	Wire #18 GA - Stranded	
1-11101	Support Cover	
1-15583	Pull - Front Panel	
1-13772	Front Panel	
2-11126	Welded Assembly Plug-In Amp	
2-11120	Assembly PC Bd "A" Amp	
2-11121	Assembly PC Bd "B" Amp.	
2-11134	Assembly A&B Range Sw	
1-11124	Rear Plate	





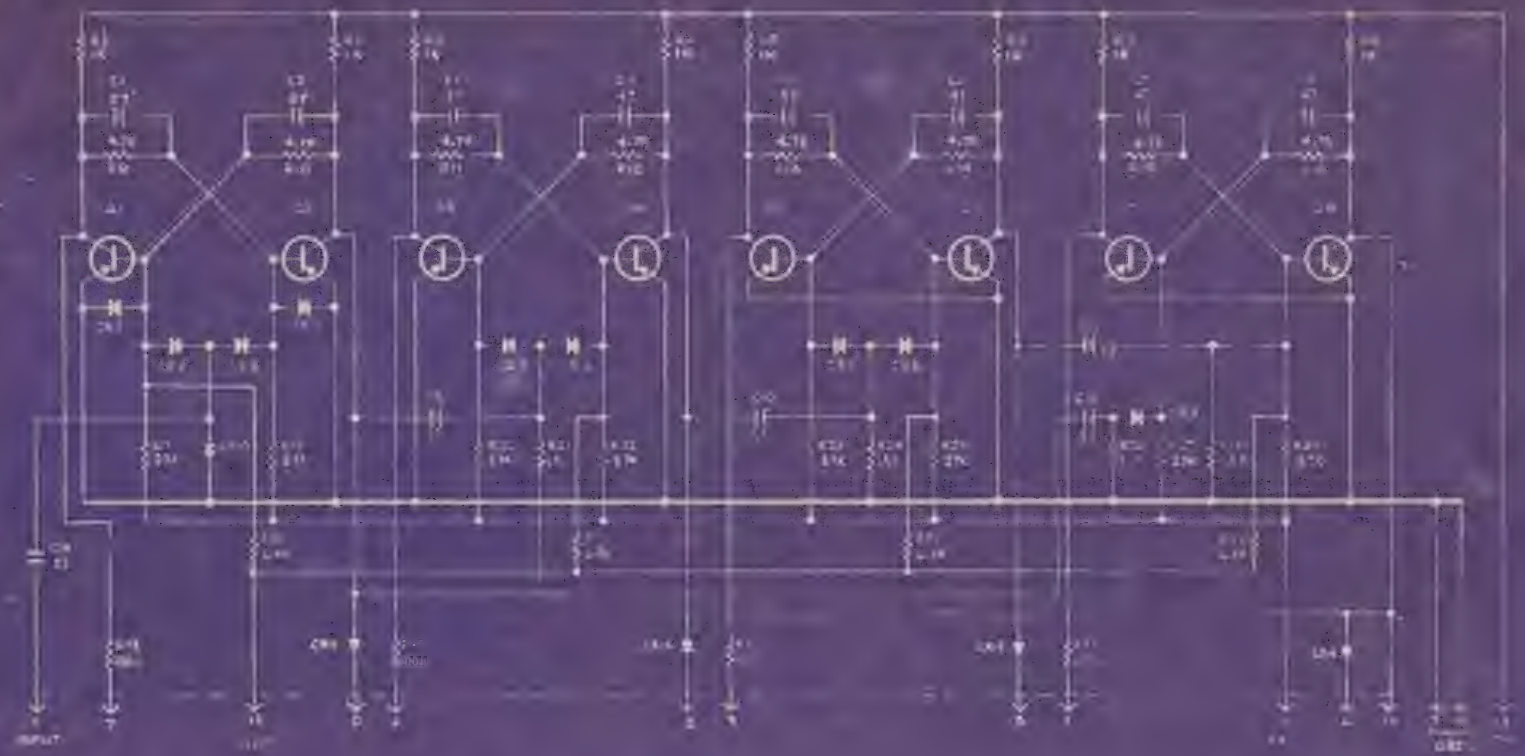
"A" AMPLIFIER

NOTES

UNLESS OTHERWISE SPECIFIED ON DRAWING

1. ALL RESISTORS ±5%, 0.25 W.
2. ALL CAPACITORS ±10% 50V MIN.
3. CAPACITOR VALUES LESS THAN 1.0 TO BE IN μFd.
4. CAPACITOR VALUES GREATER THAN 1.0 TO BE IN PFd.
5. ALL DIODES PER SYSTRON DONNER CORP SPEC NO G 6700
6. R108 IS SELECTED VALUE.

"A" AMPLIFIER SCHEMATIC



NOTES: UNLESS OTHERWISE SPECIFIED.

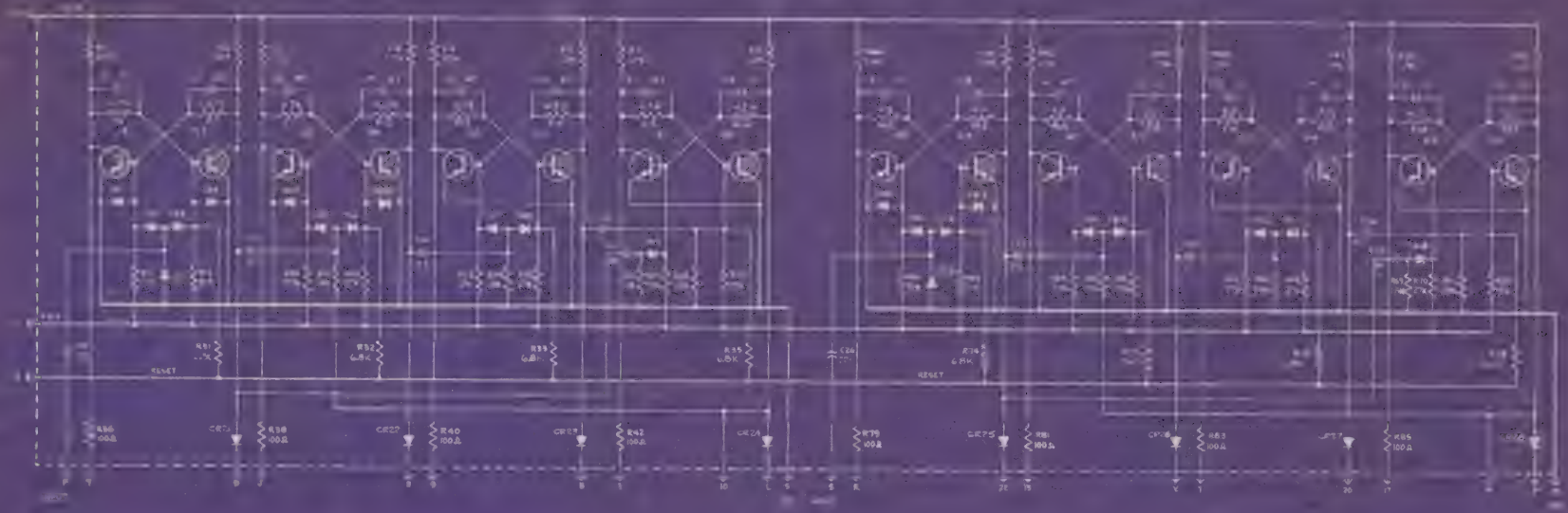
1. ALL RESISTOR VALUES IN OHMS
2. RESISTORS [illegible] WATT
3. [illegible] VALUES IN MFD
4. ALL TRANSISTORS TYPE 19-16000 .
5. ALL DIODES TYPE CDG262 .

DRAWN BY	DATE	UNLESS SPECIFIED
[illegible]	[illegible]	[illegible]

TITLE

3.0 MC DECADE - SCHEMATIC

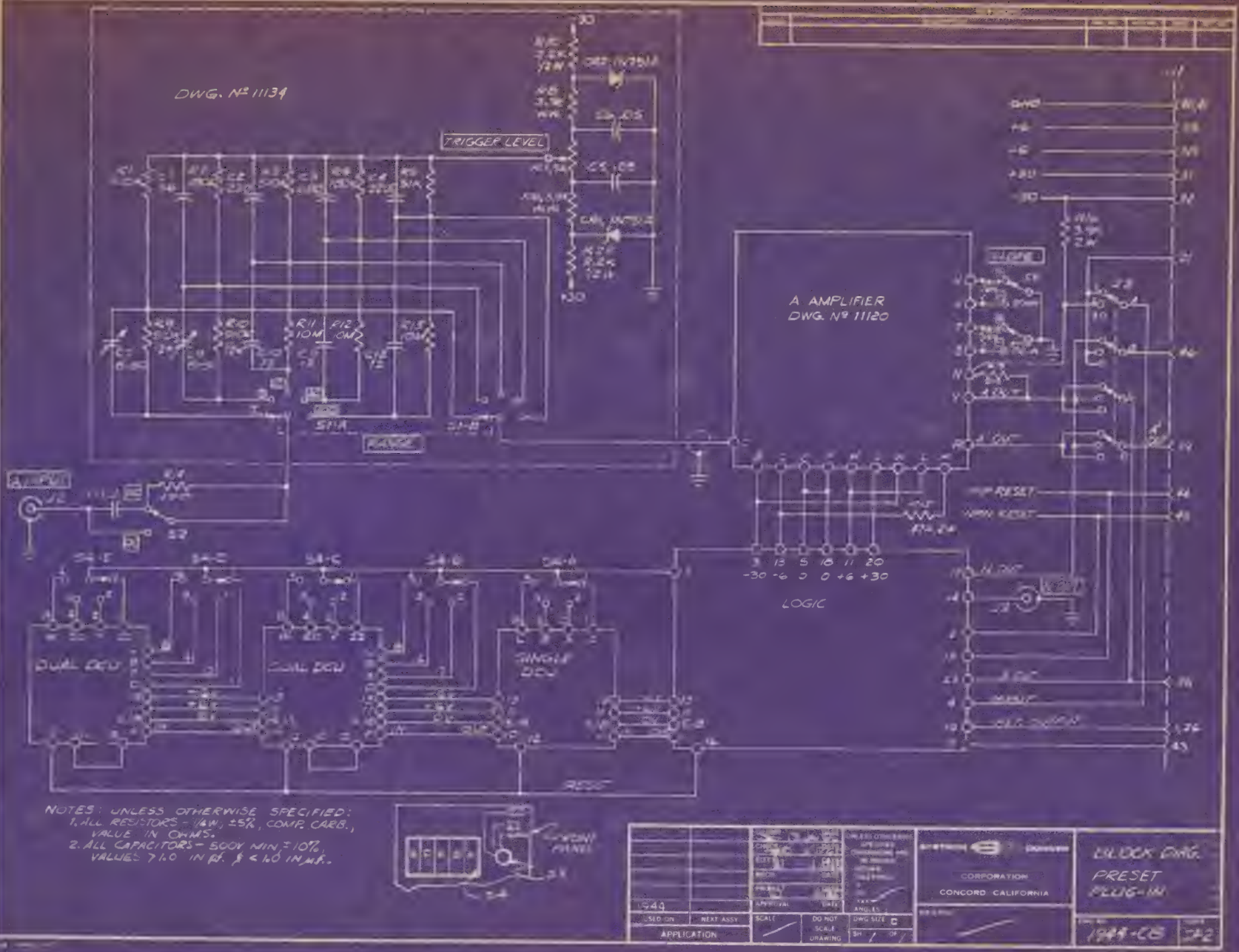
[illegible]



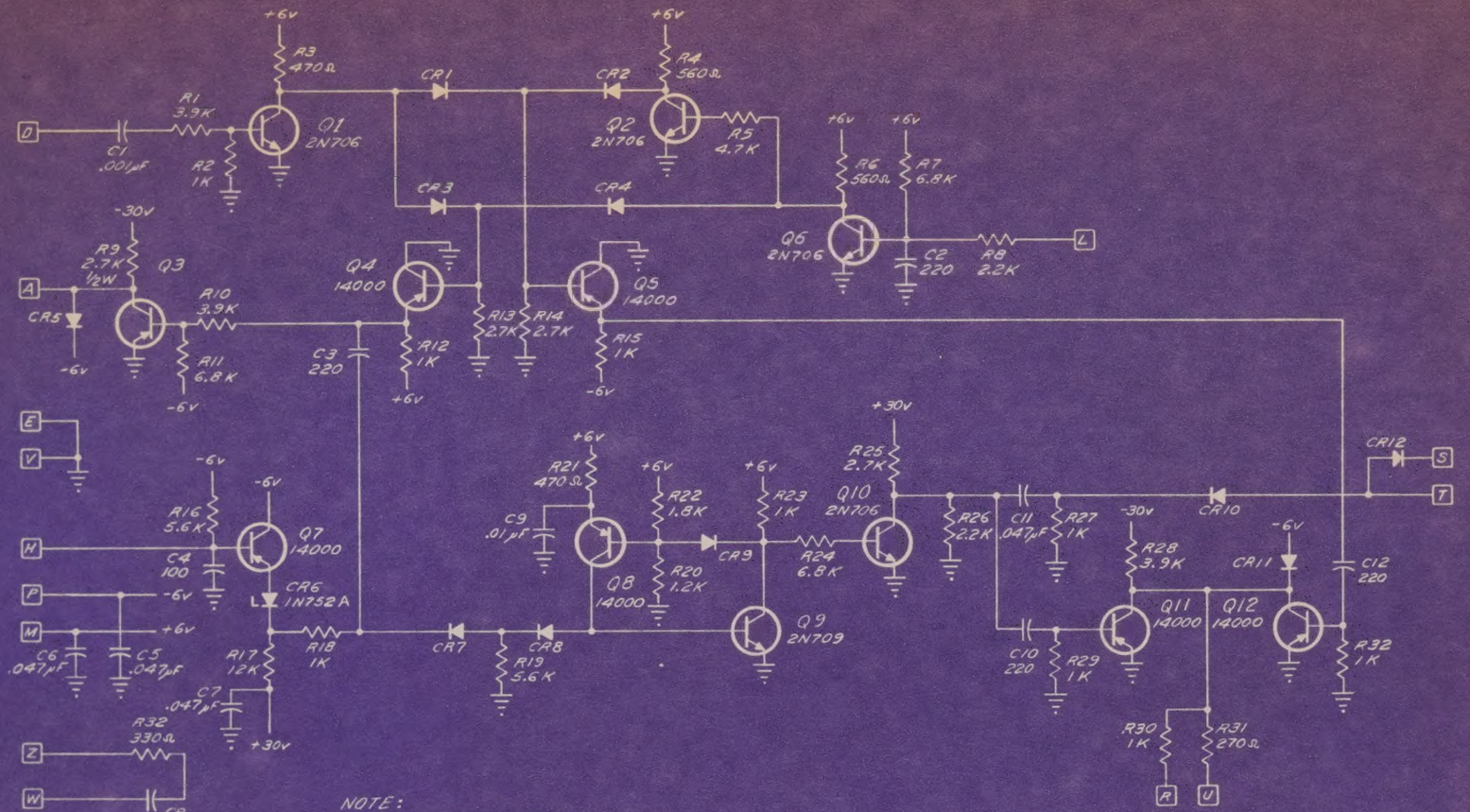
NOTE: UNLESS SPECIFIED:

1. ALL RESISTORS 1/4W, 5% COMP. CARBON.
2. ALL CAPACITORS VALUES IN μF ± 5%.
3. ALL TRANSISTORS TYPE [illegible]
4. ALL DIODES TYPE [illegible]

[illegible] DECADE


DWG. Nº 11134
TRIGGER LEVEL
A AMPLIFIER
DWG. Nº 11120
LOGIC
DUAL DCU
DUAL DCU
SINGLE DCU
RESET
NOTES: UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTORS - 1/4W, ±5%, COMP. CARB., VALUE IN OHMS.
2. ALL CAPACITORS - 500V MIN. ± 10%, VALUES ≥ 1.0 IN Mf. & < 1.0 IN MMF.
CONCORD CALIFORNIA
BLOCK DWG.
PRESET
PLUG-IN
1944-CB

REVISIONS					
ISSUE	DESCRIPTION	SER. NO.	ECO NO.	DATE	APP. BY



NOTE:
UNLESS OTHERWISE SPECIFIED.
1) CAPACITORS IN μF.
2) RESISTORS - ¼W, 5%.
3) DIODES CDG262.
4) ☐ INDICATES PINS OF PC CARD PLUG STRIP.

ITEM NO.	QTY	PART NUMBER	DESCRIPTION	SCHEMATIC REF. NO.

LIST OF MATERIALS

DRAWN	DATE	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMAL TOLERANCE .X .XX .XXX ANGLES ±	SYSTRON DONNER CORPORATION CONCORD, CALIFORNIA
CHECK	DATE		
ELECT.	DATE		
MECH.	DATE		
PROJECT	DATE		
APPROVAL	DATE		
USED ON	NEXT ASSY		
APPLICATION			
SCALE	DO NOT SCALE DRAWING	DWG SIZE C SH 1 OF 1	MATERIAL

CONTROL CIRCUIT SCHEMATIC

DWG NO. 17097 ISSUE 1

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